AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1.-50. (canceled).

51. (currently amended): A refractive projection objective for imaging a pattern, arranged in an object plane of the projection objective, into an image plane of the projection objective~~ with the aid of an immersion medium that is arranged between a last optical element of the projection objective and the image plane~~, comprising

a first lens group directly following the object plane and of negative refractive power;

a second lens group directly following the first lens group and of positive refractive power;

a third lens group directly following the second lens group and of negative refractive power;

a fourth lens group directly following the third lens group and of positive refractive power;

a fifth lens group directly following the fourth lens group and of positive refractive power; and

a system diaphragm that is arranged in a transition region from the fourth lens group to the fifth lens group,

wherein the fourth lens group has an entrance surface that lies in the vicinity of a point of inflection of a marginal ray height between the third lens group and the fourth lens group, and no negative lens of substantial refractive power is arranged between the entrance surface and the system diaphragm, and

wherein the fifth lens group has exclusively lenses of positive refractive power.

52. (previously presented): The projection objective as claimed in claim 51, wherein only positive lenses are arranged between the entrance surface and the system diaphragm.

53. (canceled).

54. (currently amended): The projection objective as claimed in claim 51, wherein a waist of minimal beam diameter exists in the region of the third lens group, and a lens pair having lenses immediately following one another and for which $\phi_i * \phi_{i+1} < 0$ exists between this waist and the image plane at only one location, ϕ_i and ϕ_{i+1} being the refractive powers of the lenses of the lens pair, and $|\phi_i| > 0.12\ m^{-1}$.

55. (previously presented): The projection objective as claimed in claim 51, wherein lens pairs having lenses immediately following one another and for which $\phi_i * \phi_{i+1} < 0$ exists between the object plane and the image plane only at three locations, ϕ_i and ϕ_{i+1} being the refractive powers of the lenses of the lens pair, and it being preferred that $|\phi_i| > 0.12\ m^{-1}$.

56. (previously presented): The projection objective as claimed in claim 51, wherein the first lens group includes at least one aspheric surface.

57. (previously presented): The projection objective as claimed in claim 51, wherein the first lens group includes at least two lenses each having one aspheric surface.

58. (previously presented): The projection objective as claimed in claim 51, wherein there is arranged in a first lens region in which the principal ray height is large as against the marginal ray height, at least one aspheric surface that has a curvature which has at most one point of inflection in an optically useful range.

59. (currently amended): The projection objective as claimed in claim ~~51~~58, wherein not more than three aspheric surfaces having one or more points of inflection are arranged in the first lens region.

60. (currently amended): The projection objective as claimed in claim 51, wherein the aspheric surfaces of a first lens region fulfill the condition $|\Sigma C1_i| * 10^6 > 0.22$, $C1_i$ being the coefficient of ~~the~~ a term h^4 of the aspheric surface representation of the ith surface.

61. (previously presented): The projection objective as claimed in claim 51, wherein a number of at least two aspheric surfaces with an optically useful diameter of more than 20% of an overall length of the projection objective are concave.

62. (previously presented): The projection objective as claimed in claim 51, wherein there are arranged in a second lens region, which extends between the object plane and a region in which a principal ray height corresponds substantially to a marginal ray height, at least two aspheric surfaces whose aspheric contributions to the distortion are of opposite signs.

63. (previously presented): The projection objective as claimed in claim 51, wherein at least one aspheric surface is provided in the third lens group.

64. (currently amended): A refractive projection objective for imaging a pattern, arranged in an object plane of the projection objective, into an image plane of the projection objective, comprising

a first lens group directly following the object plane and of negative refractive power;

a second lens group directly following the first lens group and of positive refractive power;

a third lens group directly following the second lens group and of negative refractive power;

a fourth lens group directly following the third lens group and of positive refractive power;

a fifth lens group directly following the fourth lens group and of positive refractive power; and

a system diaphragm that is arranged in a transition region from the fourth lens group to the fifth lens group,

wherein the fourth lens group has an entrance surface that lies in the vicinity of a point of inflection of a marginal ray height between the third lens group and the fourth lens group, and no negative lens of substantial refractive power is arranged between the entrance surface and the system diaphragm, and

~~The projection objective as claimed in claim 51,~~ wherein at least one aspheric surface is arranged in each lens group.

65. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein at least two aspheric surfaces have a deformation of more than 1.2 mm relative to an assigned enveloping sphere.

66. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein the condition $0.9 * PSA31 < PSA3 < 1.1 * PSA31$ is fulfilled for the spherical pupil aberration PSA, PSA31 being the sum of the aberration coefficients of the spherical pupil aberration of all the surfaces within a first lens region, and PSA3 being the sum of the aberration coefficients of the spherical pupil aberration of all the surfaces of the system.

67. (currently amended): The projection objective as claimed in claim ~~51~~64, which has an object/image distance L and a focal length f' and is adapted to an immersion medium with a refractive index n_I, the following condition being fulfilled: $L/f' * n_I > 2.5$.

68. (currently amended): A refractive projection objective for imaging a pattern, arranged in an object plane of the projection objective, into an image plane of the projection objective, comprising

a first lens group directly following the object plane and of negative refractive power;

a second lens group directly following the first lens group and of positive refractive power;

a third lens group directly following the second lens group and of negative refractive power;

a fourth lens group directly following the third lens group and of positive refractive power;

a fifth lens group directly following the fourth lens group and of positive refractive power; and

a system diaphragm that is arranged in a transition region from the fourth lens group to the fifth lens group,

wherein the fourth lens group has an entrance surface that lies in the vicinity of a point of inflection of a marginal ray height between the third lens group and the fourth lens group, and no negative lens of substantial refractive power is arranged between the entrance surface and the system diaphragm, and

~~The projection objective as claimed in claim 51,~~ wherein the system diaphragm has a diaphragm edge that determines the diaphragm diameter and whose axial position with reference to the optical axis of the projection objective can be varied as a function of the diaphragm diameter.

69. (currently amended): The projection objective as claimed in claim ~~51~~68, wherein the system diaphragm is designed as a spherical diaphragm or as a conical diaphragm.

70. (currently amended): The projection objective as claimed in claim ~~51~~68, wherein the system diaphragm is axially displaceable.

71. (previously presented): The projection objective as claimed in claim 51, wherein there is provided in a transition region from the third lens group to the fourth lens group at least one lens doublet that comprises a negative lens of weakly refractive power and a positive lens following directly in the transmission direction, the negative lens having an image-side concave surface, and the subsequent positive lens having an object-side concave surface.

72. (previously presented): The projection objective as claimed in claim 71, wherein the positive lens is a positive meniscus lens that is concave relative to the object plane and has an entrance-end lens radius R1 and an exit-end lens radius R2, and fulfills the following condition: $(R1 + R2)/(R1 - R2) < -1.5$.

73. (previously presented): The projection objective as claimed in claim 71, wherein mutually facing concave surfaces of the lens doublet are aspheric.

74. (previously presented): The projection objective as claimed in claim 51, wherein at least one meniscus lens that is concave relative to the object plane and fulfills the condition $D_L/D_{min} > 1.3$ is arranged in the fourth lens group, D_{min} being the smallest light pencil diameter in the fourth lens group and D_L being the maximum light pencil diameter in the meniscus lens.

75. (previously presented): The projection objective as claimed in claim 51, wherein all the lenses consist of the same material.

76. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein a predominant number of lenses consists of synthetic quartz glass, at least two of the lens elements arranged in the immediate vicinity of the image plane consisting of a fluoride crystal material of the same crystal orientation.

77. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein a predominant number of lenses consists of synthetic quartz glass, at least one positive lens made from a fluoride crystal material being provided in the second lens group.

78. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein a predominant number of lenses consists of synthetic quartz glass, at least one positive lens made from fluoride crystal material being provided in the fourth lens group.

79. (currently amended): The projection objective as claimed in claim ~~51~~64, wherein a predominant number of lenses consists of synthetic quartz glass, at least one negative lens of the third lens group consisting of fluoride crystal material.

80. (previously presented): The projection objective as claimed in claim 51, which has an image-side numerical aperture NA $\geq$ 0.98.

81. (previously presented): The projection objective as claimed in claim 51, wherein the projection objective is adapted to an immersion medium that has a refractive index n > 1.3 at an operating wavelength.

82. (previously presented): The projection objective as claimed in claim 51, wherein the projection objective has an image-side working distance of at least one millimeter.

83. (previously presented): The projection objective as claimed in claim 51, having an object-side working distance that is smaller than 20 mm.

84. (previously presented): The projection objective as claimed in claim 51, wherein the projection objective has an object-side working distance that is smaller than 50% of the object field diameter.

85. (previously presented): The projection objective as claimed in claim 51, wherein the projection objective has an object-side working distance that lies between approximately 5 mm and approximately 25% of the object field diameter.

86. (previously presented): The projection objective as claimed in claim 83, wherein the projection objective has an image-side numerical aperture NA > 0.8.

87. (previously presented): The projection objective as claimed in claim 51, wherein the second lens group has at least four consecutive lenses of positive refractive power.

88. (previously presented): The projection objective as claimed in claim 51, wherein on an entrance side facing the object plane the second lens group has at least one

meniscus lens, concave relative to the object plane, of positive refractive power and, on the exit side facing the image plane, the second lens group has at least one meniscus lens, convex relative to the object plane, of positive refractive power.

89. (previously presented): The projection objective as claimed in claim 51, wherein the second lens group in this sequence has at least one meniscus lens, concave relative to the object plane, of positive refractive power, a biconvex positive lens and at least one meniscus lens, concave relative to the image plane, of positive refractive power.

90. (previously presented): The projection objective as claimed in claim 51, wherein the third lens group has only lenses of negative refractive power.

91. (previously presented): The projection objective as claimed in claim 51, wherein in an object-side entrance region the fourth lens group has at least one meniscus lens, concave relative to the object plane, of positive refractive power.

92. (previously presented): The projection objective as claimed in claim 51, wherein the fifth lens group has at least one meniscus lens of positive refractive power and lens surfaces that are concave toward the image.

93. (previously presented): The projection objective as claimed in claim 51, wherein the fifth lens group has as last optical element a planoconvex lens that has a spherical or aspherically curved entrance surface and a substantially flat exit surface.

94. (previously presented): The projection objective as claimed in claim 93, wherein the planoconvex lens is of non-hemispherical design.

95. (previously presented): The projection objective as claimed in claim 51, which is a one-waist system having a belly near the object, a belly near the image and one waist lying therebetween.

96. (previously presented): The projection objective as claimed in claim 51, wherein a maximum marginal ray height is at least twice as large as the marginal ray height at the location of the narrowest constriction.

97. (previously presented): The projection objective as claimed in claim 51, wherein a belly near the object has a first belly diameter, and a belly near the image has a second belly diameter, and wherein a belly diameter ratio between the second and the first belly diameters is more than 1.1.

98. (previously presented): The projection objective as claimed in claim 51, wherein the image plane follows directly after the fifth lens group such that apart from the first to fifth lens group the projection objective has no further lens or lens group.

99. (previously presented): A projection exposure machine for microlithography comprising a refractive projection objective as claimed in claim 51.

100. (currently amended): A method for producing semiconductor components and other finely structured components, having the following steps:

providing a mask with a prescribed pattern;

illuminating the mask with ultraviolet light of a prescribed wavelength;

imaging an image of the pattern onto a photosensitive substrate, arranged in the region of the image plane of a projection objective, with the aid of a projection objective in accordance with claim 51.~~;~~

~~wherein an immersion medium is arranged between a last optical surface of the projection objective and the substrate being transirradiated during projection.~~

101. (new): The method as claimed in claim 100, wherein an immersion medium is arranged between a last optical surface of the projection objective and the substrate being transirradiated during projection.

102. (new): The projection objective as claimed in claim 68, which has an image-side numerical aperture NA ≥ 0.98.

103. (new): The projection objective as claimed in claim 64, wherein the projection objective is adapted to an immersion medium that has a refractive index $n > 1.3$ at an operating wavelength.

104. (new): The projection objective as claimed in claim 68, wherein the projection objective is adapted to an immersion medium that has a refractive index $n > 1.3$ at an operating wavelength.